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EVALUATION OF POLYETHYLENE VERSUS ALUMINUM ALLOY CLOSURES FOR H--ETC(U)
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REPORT NO. NADC-78027-68

LEVEL III



EVALUATION OF POLYETHYLENE ^{VERSUS} ALUMINUM ALLOY
CLOSURES FOR HYDRAULIC COMPONENTS.

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11 1 MAR 1978

9 FINAL REPORT

AIRTASK NO. A530-5303/001-2/7000-000-001
Work Unit TS 805

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

Prepared for
NAVAL AIR SYSTEMS COMMAND
Department of the Navy
Washington, D.C. 20361

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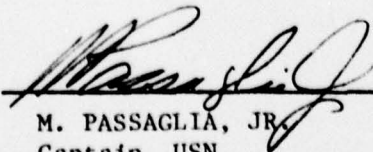
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| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|---|-----------------------|---|
| 1. REPORT NUMBER NADC-78027-60 | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) EVALUATION OF POLYETHYLENE VS. ALUMINUM ALLOY CLOSURES FOR HYDRAULIC COMPONENTS | | 5. TYPE OF REPORT & PERIOD COVERED Final Report |
| | | 6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s) A. J. RUSSO | | 8. CONTRACT OR GRANT NUMBER(s) |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS Aircraft and Crew Systems Technology Directorate Naval Air Development Center Warminster, Pennsylvania 18974 | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AIRTASK No. A530-5303/001- 2/7000-000-001 WORK UNIT TS 805 |
| 11. CONTROLLING OFFICE NAME AND ADDRESS Naval Air Systems Command Department of the Navy Washington, D. C. 20361 | | 12. REPORT DATE 1 March 1978 |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) | | 13. NUMBER OF PAGES 12 |
| | | 15. SECURITY CLASS. (of this report) Unclassified |
| | | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |
| 16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release; distribution unlimited | | |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) | | |
| 18. SUPPLEMENTARY NOTES | | |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Closures Polyethylene Aluminum Alloy Hydraulic Caps and Plugs | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Polyethylene and aluminum closures for use on lip-seal type hydraulic fittings during shipment, storage and handling were evaluated. Both types of closures were assembled repeatedly to determine the amount of contaminant generated by the closures and to evaluate the closures for thread chipping, shredding and stripping. <i>Sover</i> | | |

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The results of the evaluation indicated that closures of both polyethylene and aluminum generated essentially the same contamination and were not subject to degradation after repeated assembly.

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EVALUATION AND DISCUSSION

BACKGROUND

As requested by the Naval Air Systems Command (AIR-530312) under AIRTASK A530-5303/001-2/7000-000-001, Work Unit TS 805, the Naval Air Development Center evaluated the contamination generation characteristics of the high density polyethylene formed screw caps and plugs versus metal aluminum alloy machined closures.

The primary use of these closures is to protect the threads, flares and sealing surfaces of hydraulic units and to prevent the intrusion of dust, dirt, moisture and foreign matter into parts during storage and shipment. These closures are covered by reference (a), which specifies the use of metal closures. Specifically, in this evaluation, it was desired to ascertain if formed polyethylene closures could be used in place of expensive machined aluminum closures which were proposed for the new lip-seal separable hydraulic connectors. Figures 1 through 4 illustrate the various types and sizes of polyethylene and aluminum test closures that were evaluated.

TEST DETAILS

A Greer hydraulic test stand filled with MIL-H-83282 hydraulic fluid was used to conduct the contamination tests on the polyethylene and aluminum closures in sizes -8, -12 and -21. The fluid was filtered for four (4) hours prior to testing and analyzed for initial contamination.

All samples were subjected to fifteen (15) repeated assemblies, in accordance with paragraph 4.2.2.3, Repeated Assembly, of reference (a). Visual inspection was made on each closure during the repeated assembly testing for any unusual failures. One hundred milliliter of hydraulic fluid was collected from each sample after fifteen removals, and was analyzed for contaminant using a HiAc Particle Counter, Model PC-305.

TEST RESULTS

The repeated assembly test was passed successfully by all closures. The results of the contamination level tests after fifteen cycles of assembly are shown in Table 1. The results show, generally, little difference between the polyethylene and aluminum closures in the number of contamination particles generated. The largest amount of contamination generated on any sample did not exceed Class 7 of NAS Standard 1638. No unusual occurrences, such as thread chipping, shredding, jumping or stripping occurred during the fifteen (15) assemblies on any samples.

CONCLUSIONS

Based on the repeated assembly and contamination tests conducted, the polyethylene and aluminum screw caps and plugs were both found to be satisfactory closures.

Since no degradation occurred and the contamination generated by both the polyethylene and aluminum closures after the fifteen (15) assemblies was essentially equal and was less than Class 8 of NAS Standard 1638, either material is considered acceptable for use in Navy Aircraft and Ground Support Equipment. Specifically, either material is considered acceptable for lip-seal type closures to be used with lip-seal fittings. Based on the test of these particular type of closures, either the polyethylene or aluminum would be considered acceptable for the MS type fittings also.

The polyethylene closures for lip-seal connectors are molded while the aluminum are machined. Because of these different manufacturing methods, the aluminum closures are approximately eighty (80) times more expensive than the polyethylene closures.

It is further recommended, based on the cost, that the polyethylene closures be utilized for lip-seal fittings.

REFERENCES

- (a) MIL-C-5501F Caps and Plugs, Protective, Dust and Moisture Seal, General Specification of 20 Mar 1973

TABLE 1. RESULTS OF PARTICLE COUNT - PLASTIC VS. METAL THREADED CLOSURES
NUMBER OF PARTICLES* PER 100 MILLILITER OF HYDRAULIC FLUID
MIL-H-83282

| Nomenclature | Microns Size | | | | | |
|---|--------------|---------|----------|----------|-----------|----------|
| | Size | 5 to 15 | 15 to 25 | 25 to 50 | 50 to 100 | Over 100 |
| Polyethylene (Plastic) Screw Cap Figure (1) | DC-8 | 8852 | 332 | 51 | 9 | 0 |
| | DC-12 | 7266 | 350 | 66 | 0 | 0 |
| | DC-21 | 11632 | 576 | 94 | 0 | 0 |
| Polyethylene Screw Plugs Figure (1) | DP-8 | 22447 | 1237 | 170 | 42 | 0 |
| | DP-12 | 11961 | 478 | 80 | 9 | 0 |
| | DP-21 | 8220 | 294 | 52 | 0 | 0 |
| Aluminum Alloy Screw Caps - Teflon Insert Figure (2) | DP-8 | 4276 | 122 | 27 | 0 | 0 |
| | DP-12 | 15454 | 690 | 103 | 11 | 0 |
| | DP-21 | 7160 | 399 | 119 | 0 | 0 |
| Aluminum Alloy Screw Plugs - "O" Ring Seal Figure (2) | DP-8 | 9170 | 456 | 66 | 0 | 0 |
| | DP-12 | 8755 | 369 | 63 | 0 | 0 |
| | DP-21 | 10202 | 543 | 103 | 0 | 0 |
| Aluminum Alloy Screw Caps - "O" Ring Seal Figure (3) | DP-8 | 15494 | 964 | 197 | 26 | 1 |
| | DP-12 | 10798 | 433 | 101 | 13 | 0 |
| | DP-21 | 22350 | 1067 | 238 | 37 | 1 |
| Aluminum Alloy Screw Cap - MIL-C-5501 Figure (4) | DP-8 | 23627 | 1553 | 318 | 32 | 1 |
| Aluminum Alloy Screw Plug - MIL-C-5501 Figure (4) | DP-8 | 22162 | 930 | 176 | 16 | 0 |
| NAS Standard 1638 Class 7 specifies maximum contamination level | | 32000 | 5700 | 1012 | 180 | 32 |

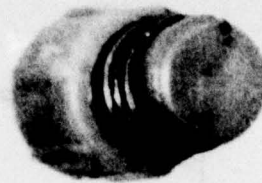
*Average of six (6) runs

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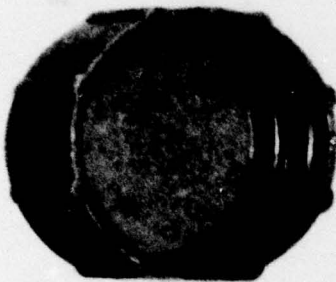


Screw Cap

-8 Size



Screw Plug



Screw Cap

-12 Size

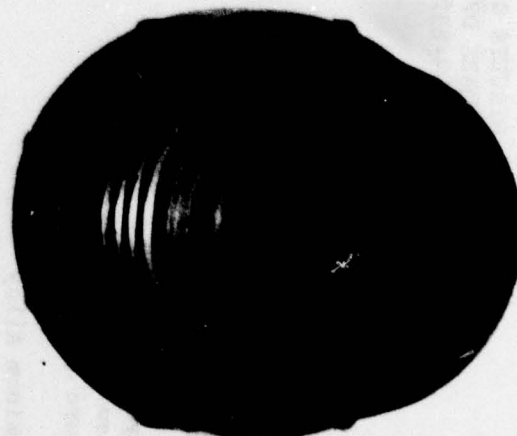


Screw Plug



Screw Cap

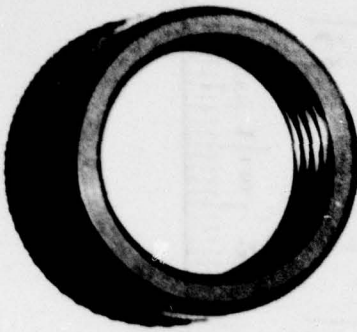
-21 Size



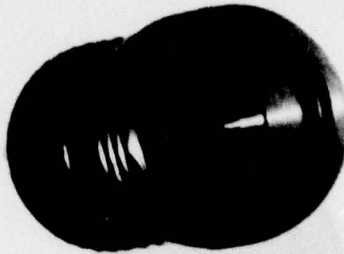
Screw Plug

FIGURE 1. MOLDED POLYETHYLENE (PLASTIC) CLOSURES

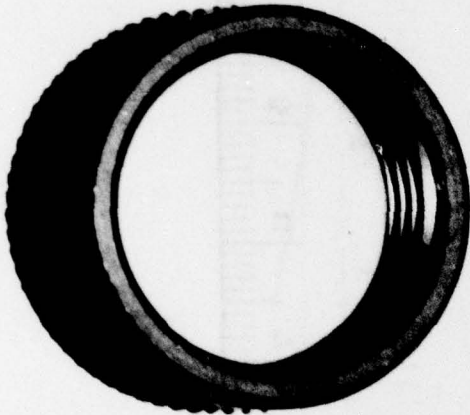
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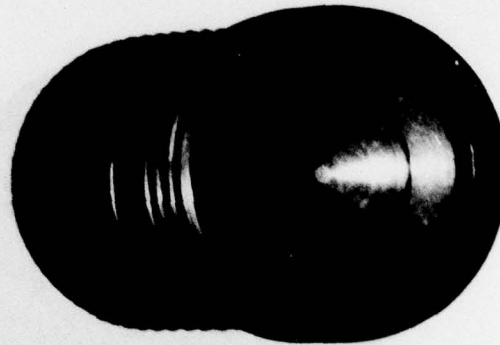
Screw Cap
-8 Size
Teflon Gasket Seal



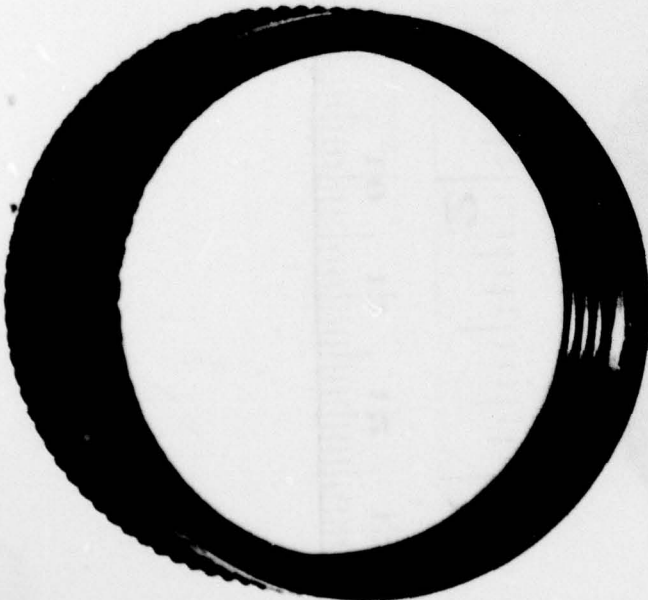
Screw Plug
-8 Size
"O" Ring Seal



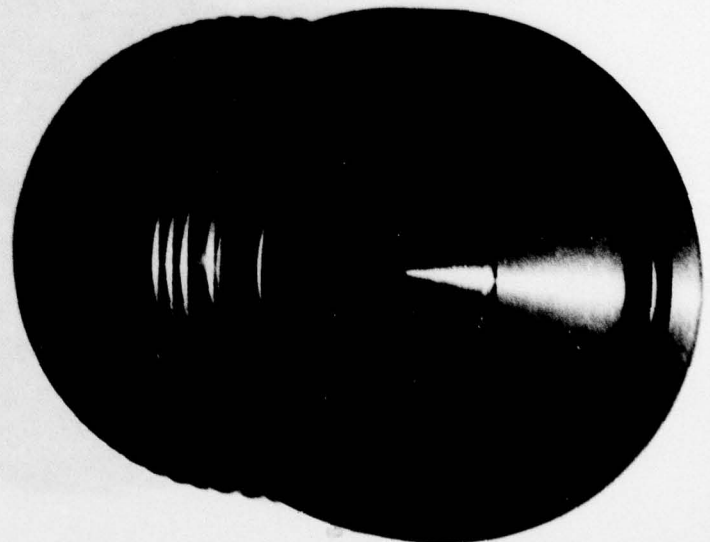
Screw Cap
-12 Size
Teflon Gasket Seal



Screw Plug
-12 Size
"O" Ring Seal



Screw Cap -21 Size
Teflon Gasket Seal



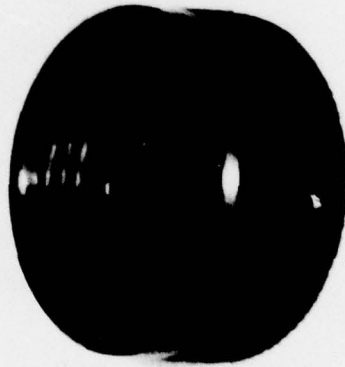
Screw Plug -21 Size
"O" Ring Seal

FIGURE 2. MACHINED ALUMINUM ALLOY CLOSURES

Screw Cap
with "O" Ring Seal
-8 Size



Screw Cap
with "O" Ring Seal
-12 Size



Screw Cap
with "O" Ring Seal
-21 Size

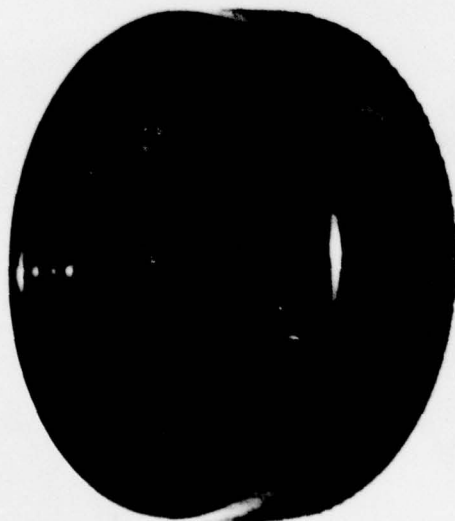
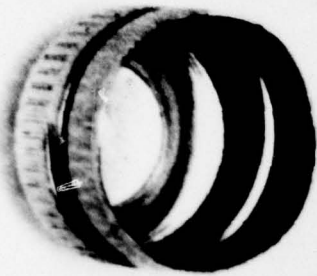
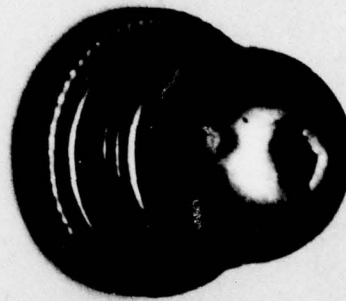


FIGURE 3. MACHINED ALUMINUM ALLOY CLOSURES



M5501/3
Screw Cap
-8 Size



M5501/1
Screw Cap
-8 Size

FIGURE 4. ALUMINUM ALLOY CLOSURES - PRESSED FORMED
SPEC. MIL-C-5501 - FLARED FITTINGS

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